

ANNUAL REPORT
OF
THE IMPERIAL BACTERIOLOGIST

FOR THE YEAR ENDING THE 31ST MARCH 1916.

Muktesar Laboratories.

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FOR THE YEAR ENDING THE 31ST MARCH 1916.

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Annual Report of the Imperial Bacteriologist

For the year ending the 31st March 1916.

I. ADMINISTRATION.

I held charge of the current duties of the Imperial Bacteriologist throughout the year, in addition to my own duties as Assistant Bacteriologist.

2. Dr. G. H. K. Macalister, M.A., M.D., D.P.H., held the office of Pathologist throughout the year.

3. Dr. R. V. Norris, M.Sc., A.I.C., D.Sc., held the post of Physiological Chemist up to the 6th October 1915, when he left Muktesar to join temporarily the Indian Army Reserve of Officers.

4. Messrs. Koiller, Goffi and Mobbs, the Head, 2nd and 3rd European Laboratory Assistants respectively, were on duty throughout the year.

5. The post of Farm Manager was held by Mr. E. J. Hooper up to the 15th February 1916 from which date he was granted one month's privilege leave. On the expiration of this leave his services at the Laboratory terminated.

Mr. Goffi, the 2nd European Laboratory Assistant, has been discharging the duties of Farm Manager, in addition to his own, with effect from the 16th February 1916.

6. Mr. T. Morgan held the post of Electrician up to the 11th December 1915; he then joined the Motor Transport Service.

Mr. N. N. Ghose, the Assistant Electrician, held charge of the office of Electrician, in addition to his own duties, from the 12th December 1915 to the 22nd February 1916, on which date he was relieved by Mr. W. A. Noel.

Mr. Noel has since been relieved by Mr. S. E. Andrews, whose appointment, as Engineer at this Laboratory has been sanctioned by the Secretary of State.

7. Consequent on the death of Mr. D'Monte, Veterinary Deputy Superintendent, on the 12th July 1915, Veterinary Inspector Mr. J. D'Costa was appointed Veterinary Deputy Superintendent, with effect from the 13th July 1915.

The post of a Veterinary Inspector rendered vacant by Mr. D'Costa's promotion was not filled up until the 24th November 1915, on which date Mr. J. R. Blide, a graduate from Bombay Veterinary College, was appointed.

The other three Veterinary Inspectors remained in their respective appointments throughout the year.

The new post of Veterinary Deputy Superintendent for the inoculation of cattle in the Military Dairies sanctioned in Government of India, Army Department No. 23640-1-(Q.M.G. 9), dated the 13th January 1916, has not yet been filled, but arrangements are being made for the early appointment of a qualified officer to this post.

8. *Fodder Supply.* Some difficulty was experienced in obtaining an adequate supply of hay during the winter months owing to reliance having to be placed on local contractors. Poor crops and shortage of labour appear to have produced this position outside Muktesar, while the overgrowth of our own forest has led to a large decrease in the production of grass within our boundary. Ultimately an

amount was delivered which with care will meet our requirements until next autumn, but the need has been demonstrated of further supplementing our present sources of supply. With this object steps have been taken to cultivate certain areas within the estate and already a considerable amount of ground has been reclaimed and ploughed ready for sowing with English clovers and grasses ; by this means it is hoped to provide a certain quantity of green fodder for our animals.

Satisfactory arrangements were made for the supply of grain.

9. *Forests.* A large quantity of dry and fallen wood was extracted from these areas in addition to the fuel obtained from the coupe of the year. The contractor of the District Forests also supplied the balance of ten thousand maunds of fuel contracted for during the last official year.

As the result of an interview which I had with the Inspector General of Forests, at Naini Tal in June 1915, the Forest Department have decided to prepare a new Working Plan for the Muktesar forest, under which they expect to be able to provide at least 20,000 maunds of fuel annually instead of 10,000 maunds as under the old working plan ; this would obviate the necessity of obtaining fuel from the District Forests in future.

10. *Water Supply.* With our present inadequate arrangements the question of water supply becomes more difficult each year. The shortage is greatest during the three months preceding the break of the monsoon, and for the whole of that time the work of the Laboratory is carried on under great difficulties, as most of the water has to be carried by hand and pack ponies from a considerable distance.

A new electrically driven pump was erected early in the year, but the discharge from the spring proved quite insufficient.

The Public Works Department now consider that the hydram scheme is impracticable and propose substituting

electrical pumping from a point some 1,200 feet below the level of the Laboratory.

11. *Electric Centrifuges.* Some of the old condemned centrifuges have been kept running throughout the year by constant attention and repair, but the risk has been considerable; at the close of the year under report three only remained in workable condition but none are likely to last very long.

Three of the new centrifuges have been delivered and are now awaiting erection.

12. *Supply of Hill bulls and Plains animals.* There was no change in the arrangements for obtaining hill bulls and plains animals, nor was any difficulty experienced in procuring them.

13. *Bareilly Branch Laboratory.* As usual the Branch Laboratory remained open for about five months during the winter season.

In addition to the routine work of testing sera and vaccines, examination of specimens, etc., investigations were carried out in connection with Blackquarter, Anthrax, Strangles, and Tuberculosis of cattle.

During September 1915, the Imperial Pathological Entomologist deputed one of his subordinates to collect biting flies at Kathgodam and with his help up to the end of December, a series of experiments were conducted on the transmission of surra by certain of these flies.

Work on the construction of the new branch laboratory at Izatnagar has been delayed owing to the total cost of the project having been found to be excessive under the present financial conditions. A revised scheme on more humble lines has been suggested and the estimates for this are under preparation by the Public Works Department.

14. *Tours.* In November 1915 and again in March 1916, I visited the Army Remount Depôts at Mona and

Sargódha, and with the assistance of the Veterinary Officers of the Depôts carried out a number of experiments on the immunization of the young stock against Strangles.

I attended the Science Congress held at Lucknow on January 13th to 15th, 1916, and presented a paper on "Protective Inoculation of Stock in India."

From February 7th to 12th, I attended the meeting of the Board of Agriculture held at the Agricultural Research Institute, Pusa, Bihar.

During August 1915, Dr. Macalister toured with the Superintendent, Civil Veterinary Department, in Bihar, in connection with the investigation of the disease Kumri of horses.

II. PREPARATION OF SERUMS AND VACCINES.

15. *Rinderpest Serum.* During the year 1915-16, 1,186,550 doses of rinderpest serum were prepared and 969,160 doses issued against 1,383,560 doses prepared and 1,382,050 issued during the year 1914-15.

The decrease in the demand for this serum is mainly accounted for by the reduced prevalence of the disease in most provinces; this decline was greatest in the United Provinces, Bihar and Orissa and the Central Provinces; an increased number of outbreaks occurred in the Bombay and Madras Presidencies. Shortage of Veterinary Assistants, owing to the number that have gone on Military Service, also probably limited inoculation work in some cases.

Throughout the year a balance in hand of about two lacs of doses was maintained.

16. The total amount of the bills for sale of anti-rinderpest serum issued during the year 1915-16 comes to Rs. 1,09,566.*

* *Note.*—Bills amounting to Rs. 17,198 are still awaiting payment and have to be carried over to next year's account.

By adding to this the cost of 92,422 doses supplied free to the Military Department the total revenue from this source would amount to Rs. 1,21,119.

17. The following table collated from the re received in this office will show the results of anti-ricket fever serum injections carried out in the field during the 1915-16. . .

Province	Number of outbreaks in which inoculation was undertaken	NUMBER OF ANIMALS WHICH DIED UNINOCULATED IN COURSE OF DISEASE			NUMBER OF ANIMALS INOCULATED			NUMBER OF ANIMALS WHICH DIED AFTER INOCULATION			RE:
		Equines	Bovines	Others	Equines	Bovines	Others	Equines	Bovines	Others	
Panjab . . .	125	...	2,163	...	...	25,460	..	...	13	...	
N.-W. F. P., and N. Panjab.	40	...	339	...	...	10,020	...	...	4	...	
United Provinces	157	...	1,141	18	...	14,198	185	...	56	4	
Bengal . . .	298	..	3,407	..	...	38,932	...	...	361	...	
Assam . . .	360	...	9,164	...	...	34,831	...	..	633	...	
Bihar and Orissa	400	...	4,272	...	...	47,447	...	...	484	...	
Central Provinces	257	...	2,743	...	...	35,237	...	13	164	...	
Bombay . . .	421	...	6,555	...	...	79,706	...	...	449	...	
Madras . . .	537	...	12,682	12	...	80,812	205	...	552	...	
Sind, Baluchistan and Rajputana.	13	...	111	138	...	569	794	...	15	2	
Burma . . .	25	...	269	...	...	6,814	...	...	29	...	
Mysore State . .	*	...	*	...	...	9,939	...	...	...	...
Bengal Veterinary College.	28	...	167	...	...	3,181	...	...	5	...	
Baroda State . .	1	...	25	...	...	127	...	...	1	...	
TOTAL . . .	2,663	..	43,058	168	...	326,293	1,181	13	2,765	6	

* Figures not supplied in the statement of the Superintendent.

NOTE.—No reports received from the officers of the Military Department.

18. With reference to the above table it may be pointed out that the figures in the column "Number of animals which died after inoculation" include all those animals that were infected at the time of inoculation, which serum cannot be expected to save, and those which became infected after the protective action of the serum had passed off, as well as the more susceptible animals which the serum failed to protect; the proportion of the latter class is therefore much smaller than the figures indicate. In several instances in which the number of deaths reported following inoculation has been higher than usual, enquiry has shown that the doses of serum employed were too small in view of the obvious virulence of the outbreak. Thus the Superintendent, Civil Veterinary Department, Bihar and Orissa, in referring to the number of deaths after inoculation in the District of Puri, which amounted to 191 out of the total for the province of 484, states, "It was due to carelessness on the part of the Veterinary Assistant in not making proper enquiries into the deaths and increasing the dose (of serum) accordingly. It was no fault of the serum."

19. *Anthrax serum.* 71,870 doses of this serum were prepared and 48,337 issued during the year under report as against 18,610 doses prepared and 20,883 issued during last year.

The demand for this serum was very heavy during the early part of the year and as its preparation occupies nearly three months and the issued dose is large (15 cc.) some difficulty was experienced in complying at once with the orders.

At the close of the year a large stock remained in hand to meet any similar emergency.

20. The results obtained in the field from inoculations with anthrax serum have been very satisfactory as the

figures in the following table show :—

Provinces	Number of outbreaks in which inoculation was undertaken	NUMBER OF ANIMALS WHICH DIED UNINOCULATED IN COURSE OF DISEASE			NUMBER OF ANIMALS INOCULATED			NUMBER OF ANIMALS WHICH DIED AFTER INOCULATION			REMARKS
		Equines	Bovines	Others	Equines	Bovines	Others	Equines	Bovines	Others	
Bengal . . .	14	4	11	2	72	447	14	1	...	...
Assam . . .	73	23	572	43	692	8,881	163	...	24	...	
Bihar and Orissa .	22	1	220	...	5	2,888	...	...	3	...	
Sind, Baluchistan and Rajputana.	4	...	...	356	...	...	381	...	...	...
Mysore State . .	*	...	*	...	...	60	...	...	...	...
Madras . . .	1	...	1	...	...	61	...	...	...	...
Central Provinces.	4	...	57	...	...	254	...	...	...	...
TOTAL . . .	118	33	861	401	709	12,541	558	1	27	...	

* Figures not supplied in the statement of the Superintendent.

21. *Hæmorrhagic Septicæmia Serum and Vaccine.*
During the year under report 127,365 doses of hæmorrhagic septicæmia serum were prepared and 79,965 issued against 77,428 doses prepared and 77,328 issued in the preceding year.

The number of doses of hæmorrhagic septicæmia vaccine prepared and issued during the year 1915-16 amounted to 124,150 against 100,690 prepared and issued in the year 1914-15.

The demand for hæmorrhagic septicæmia serum, as for anthrax serum, was particularly heavy during the early half of the year, and for similar reasons could not be met immediately; the stocks in hand were also small. Steps were at once taken to greatly increase the number of serum-making

animals, several temporary sheds being erected for their accommodation and in a short time the orders were all complied with.

A large stock of hæmorrhagic septicæmia serum is now held to meet any similar demand.

As hæmorrhagic septicæmia vaccine can be prepared at short notice it is unnecessary to keep a large supply in hand.

The following table shows the quantities prepared and issued during the past five years:—

HÆMORRHAGIC SEPTICÆMIA SERUM				HÆMORRHAGIC SEPTICÆMIA VACCINE			
Year	Number of doses		Dose per animal	Year	Number of doses		Dose per animal
	Prepared	Issued			Prepared	Issued	
1911-12	30,815	28,970	10 cc.	1911-12	33,700	33,700	5 cc.
1912-13	40,931	49,219	15 cc.	1912-13	25,750	25,750	"
1913-14	57,829	63,980	"	1913-14	242,320	242,320	"
1914-15	77,128	77,328	"	1914-15	100,600	100,600	"
1915-16	127,365	70,075	"	1915-16	124,140	124,150	"

22. The following are the results of inoculations in the field with hæmorrhagic septicæmia serum and vaccine.

Province	Number of outbreaks in which inoculation was undertaken	NUMBER OF ANIMALS WHICH DIED UNINOCULATED IN COURSE OF DISEASE			NUMBER OF ANIMALS INOCULATED			NUMBER OF ANIMALS WHICH DIED AFTER INOCULATION			REMARKS
		Equines	Bovines	Others	Equines	Bovines	Others	Equines	Bovines	Others	
Punjab . . .	229	...	885	...	...	51,800	...	...	15	...	
N.-W. F. P. and Punjab.	33	...	126	...	...	10,665	...	...	...	...
United Provinces	62	...	282	...	...	4,095	...	...	...	...
Bengal . . .	16	...	136	...	...	2,020	...	...	1	...	
Assam . . .	33	1	363	...	7	4,617	2	...	23	...	
Bihar and Orissa	76	...	486	...	...	7,503	...	...	25	...	
Madras . . .	3	...	33	...	...	396	...	...	...	...
Central Provinces	29	...	117	...	...	2,923	13	...	1	...	
Sind, Baluchistan and Rajputana	18	...	200	...	...	2,263	...	...	5	...	
Bombay . . .	14	...	141	...	...	2,760	...	...	1	...	
Mysore State .	*	...	*	...	...	275	...	...	...	...
Total . . .	518	1	2,769	...	7	89,641	14	...	76	...	

* Figures not supplied in the statement of the Superintendent.

23. The following extracts refer to the use of hæmorrhagic septicæmia serum and vaccine in the field.

(1) Annual Report of the Punjab Veterinary College, 1914-15.

In referring to an outbreak of hæmorrhagic septicæmia, Colonel Pease states :—

“The usually effective measures of segregation proving ineffective, serum was telegraphed for, and 297 animals were inoculated. The serum had the effect of at once stopping the outbreak, but in the meantime the disease had become epidemic and deaths occurred daily in numbers till all incontacts had been inoculated.”

(2) Annual Report of the Superintendent, Civil Veterinary Department, North-West Frontier Province, 1914-15:—

“Two thousand seven hundred and fifty-eight vaccinations against hæmorrhagic septicæmia were made in 28 villages and the results were satisfactory.

“Five thousand five hundred and twenty-nine animals were inoculated with hæmorrhagic septicæmia serum in 6 outbreaks. The results have been checked and appear satisfactory.

“In two outbreaks in which inoculations were carried out indecisive results were obtained, *i. e.*, after inoculation was carried out neither inoculated nor uninoculated animals developed the disease.

“In four outbreaks positive results were obtained, *i. e.*, uninoculated animals developed the disease while no inoculated animals developed the disease.”

24. *Charbon Symptomatique Vaccine*. The outstanding balance of vaccine from last year, having been manufactured over three years previously, was discarded and a fresh brew of 50,000 doses was prepared and thoroughly tested at the Bareilly Laboratory. As the vaccine, to be of any protective value, must contain living, though weakened, organisms of the disease, great care is necessary to ensure that attenuation has been carried sufficiently far to render the inoculation safe but at the same time effective in producing immunity. To confirm the laboratory tests, reports were asked for from those officers to whom the new vaccine was sent and in all cases the replies received were satisfactory; the following extracts may be given as examples:—

The Superintendent, Civil Veterinary Department, Mysore, reports:—

“That the results of inoculation with the latest supply of black quarter vaccine have been successful and no complaints were received from any places where cattle were inoculated.”

The Superintendent, Civil Veterinary Department, Punjab, countersigns a report submitted by his Deputy Superintendent on black-leg vaccination.

"The above three villages were visited by me on 5th April, i.e., 10 days after the vaccination for ascertaining the results. The results are very satisfactory. One animal in village Lehga Bhandu indicated symptoms of slight swelling at the seat of inoculation and lameness on the 3rd day of inoculation and these disappeared on the 5th day of inoculation.

"The age of the animal which showed the above symptoms was 2 years.

"Animals of from 6 months to 3 years of age were vaccinated."

25. The total number of doses issued amounted to 20,257 as against 6,333 doses during the preceding year.

26. The subjoined table shows the results of inoculations in the field with Charbon Symptomatique Vaccine.

Province	Number of outbreaks in which inoculations were effected	NUMBER OF ANIMALS WHICH DIED SINCE VACCINATION COMMENCED IN DISTRICT			NUMBER OF ANIMALS INOCULATED			NUMBER OF ANIMALS WHICH DIED AFTER INOCULATION		REMARKS
		Equines	Bovines	Others	Equines	Bovines	Others	Equines	Bovines	
Punjab	11	•	•	•	3,107	•	•	•	2	•
N.W.F.P. and N. Punjab	21	•	7	•	9,379	•	•	•	•	•
United Provinces	6	•	13	•	153	•	•	•	•	•
Sud. Bencheswar and R. J. States	6	•	212	•	139	•	•	•	4	•
Bihar and Orissa	9	•	23	•	919	•	•	•	7	•
Mysore State	•	•	•	•	336	•	•	•	•	•
Hissar Cattle Farm	•	•	•	•	614	•	•	•	1	•
TOTAL	91	•	273	•	9,165	•	•	•	11	•

* Figures not supplied in the statements of Superintendent.

27. *Strangles Serum and Vaccine.* During the year 1915-16, 11,242 doses of this serum were manufactured and 17,132 issued against 16,118 doses prepared and 3,988 doses issued in 1914-15. The largest previous issue of this serum in one year was 12,192 doses in 1913-14.

In addition, 656 doses of anti-streptococcic and 1,350 doses of mixed anti-streptococcic and staphylococcic vaccines were prepared and issued.

The above serum and vaccines were supplied mainly to the Army Remount Depôts for the treatment and experimental immunization of horses against strangles.

28. *Mallein.* The demand for mallein was fully maintained; 30,332 doses being issued as against 31,104 doses in 1914-15, which was double the issue of any previous year. 28,009 doses were prepared as against 37,766 doses in 1914-15.

In addition 7,127 doses of ophthalmic mallein were prepared and 112 doses issued; this form of mallein had not previously been issued from the Muktesar Laboratory.

29. *Tuberoulin.* Out of 730 doses, the outstanding balance of the preceding year, 430 doses were issued during the year 1915-16 against 140 doses issued in 1914-15.

30. *Miscellaneous Vaccines.* During the year under report several specimens of material from various infective conditions, chiefly in horses, were received at the Laboratory and from these autogenous bacterial vaccines were prepared for use in the treatment of the infections.

In all 95 doses of staphylococcic vaccine and 205 doses of bacterial vaccines of different kinds were supplied, the reports received of their value in practice have been very satisfactory. The following is an extract from one of these reports sent by the Veterinary Officer, Army Remount Depôt, Sargodha.

"The autogenous vaccine used on a case of 'Fistulous Withers' had a very excellent effect. Following each injection there was a gradual diminution of the discharge and at the present time the fistulous openings are almost completely cicatrised."

31. *Specimens examined.* During the year under report, 125 specimens were received at the Laboratory for examination and report, against 132 during the previous year.

In the following statement the details of the specimens examined are shown :—

NAME OF DISEASE	NUMBER OF SPECIMENS		TOTAL
	Positive	Negative	
	Nos.	Nos.	Nos.
Surra	4	9	13
Anthrax	1	2	3
Piroplasmosis	6	6	12
Tuberculosis	25	4	29
Strangles	4	...	4
Fowl Cholera	1	...	1
Kumri	9	...	9
Lymphangitis Epizootica . . . . .	...	2	2
Dourine	1	...	1
Anæmia	5	...	5
Filaria	2	...	2
Tumours	9	...	9
Pneumonia	2	...	2
Miscellaneous Diseases	33	...	33
TOTAL	102	23	125

32. *Training.* During the past year one Veterinary Graduate and one Dairy Manager underwent a course of training in inoculation methods.

Mr. W. A. Pool, Professor, Punjab Veterinary College, reported his arrival at this Laboratory on 3rd July 1915 for 3 months' experimental study and left on 28th September 1915.

Mr. P. G. Patel, Assistant to the Imperial Pathological Entomologist, conducted a series of experiments with flies in the transmission of surra, at Muktesar as well as at Bareilly, for a period of about 3 months.

III. RESEARCH WORK.

33. *Rinderpest.* Up to the present no drug or combination of drugs has been found to exert any markedly beneficial effect on the course of an attack of rinderpest. Experiments in this direction have therefore been discontinued.

Observations on the preservation of rinderpest virus have been continued and extended to include a study of the duration of vitality of the virus under natural conditions. The importance of obtaining accurate information on this latter point was brought to the notice of the Board of Scientific Advice and the request was made that the investigation might be conducted at Muktesar.

A report of the experiments is being prepared and will be submitted for publication shortly.

With the object of increasing the output of serum and effecting economies in the cost of its production, without any decrease of its potency, comparative tests were carried out of various methods of bleeding the hyperimmune animals for serum. A revised procedure was found to give superior results to the existing routine method and this has now been adopted. An account of the experiments is ready for publication. At the same time the yield of serum obtained

from the blood by a new method of clotting was compared with that given by centrifugalisation alone and found to give superior results. A report of the method has been submitted for publication by Dr. Norris.

A number of serological observations were also made by Dr. Macalister with the view of ascertaining whether the potency of anti-rinderpest serum could be determined by this means instead of having to employ numbers of hill bulls for the purpose, as at present, but so far the results have been negative.

34. *Anthrax and Hæmorrhagic Septicæmia.* The long series of tests, carried out with a variety of drugs, to ascertain their effect on the course of these diseases, have been discontinued for the present as the results were not sufficiently pronounced in any case to justify further experiments.

The immunizing effect of dead vaccines, prepared in various ways from cultures of the organisms, was tested, both in the case of anthrax and hæmorrhagic septicæmia, with the object of finding a safe method of giving protection against these diseases for a longer period than is possible with anti-sera or the present hæmorrhagic septicæmia vaccine. The results in certain cases were encouraging and it is proposed to continue the experiments along these lines.

Dr. Macalister has commenced a series of observations on the standardization of the anti-sera of these diseases, but the investigation of certain biochemical questions in this connection has been interrupted by the transfer of Dr. Norris to military duty.

35. *Kumri.* The investigation into the etiology and pathology of this disease has been continued by Dr. Macalister; a preliminary report of the results arrived at up to the present time will be submitted shortly.

36. *Strangles.* A large number of inoculation experiments were carried out at the Army Remount Depôts at Mona and Sargodha, but as the disease did not make its

appearance until late in the winter, it is not yet possible to arrive at any conclusions as to the results of the experiments. The value of both anti-serum and vaccines in the treatment of the disease was frequently demonstrated and the increased issues of these agents indicate the extent to which Veterinary Officers are appreciating this fact.

37. *Contagious abortion.* No further outbreak of this disease has been reported from the Government Farm at Hissar, but its appearance amongst the mares of the donkey stud at the Army Remount Depot at Mona, towards the close of the year under report, gave an opportunity for making a bacteriological examination of the condition.

An organism has been isolated from an aborted foetus which produces abortion constantly in guinea-pigs and in other respects closely resembles the *baillus abortivo-equinus* (Good & Smith) of infectious equine abortion in America ; its further study is being pursued.

38. *Surra.* Arrangements were made with Mr. Howlett, Imperial Pathological Entomologist, to carry out an investigation on the transmission of surra by biting flies, but owing to his departure on leave the original programme could not be followed. However, he kindly placed the services of his assistant, Mr. Patel, at my disposal and with the help of this officer a number of interesting experiments were carried out at the Bareilly Laboratory. An account of these will be submitted for publication shortly.

39. *Miscellaneous.* The study of several minor subjects was also taken up during the year.

The stock of tuberculin in hand becoming low, steps were taken for the preparation of a fresh amount, but since the agent is intended for the diagnosis of tuberculosis in Indian stock, it was decided to obtain original cultures of the tubercle bacillus from cases of the disease in this country instead of relying on cultures from British sources, as had been done previously. The material for this purpose was

kindly sent to the Laboratory by Mr. G. Taylor, Superintendent, Civil Veterinary Department, South Punjab, and three different strains of the organism have been cultivated.

In addition to utilizing these for the preparation of tuberculin, a study will be made of their cultural and other characters for the purpose of determining to which variety of the organism they belong.

A form of paralysis in sheep occurring in the Aligarh district was also investigated, but neither the presence of a causal organism nor of any very pronounced lesions could be demonstrated in the cases submitted for examination.

40. The following papers were forwarded from the Laboratory for publication during the year under report:—

(a) A comparison of the defibrination and oxalate methods of serum preparation as applied to hæmorrhagic septicæmia and anthrax sera together with some analyses of buffalo and hill bull blood by Dr. R. V. Norris, Physiological Chemist, Imperial Bacteriological Laboratory. *Pusa Agri. Res. Inst. Bull.*, No. 60.

(b) A note on the diagnosis of glanders by A. W. Shilston, M.R.C.V.S., Assistant Bacteriologist in charge of the office of the Imperial Bacteriologist. *Agri. Jour. Ind.*, Vol. XI, Part I.

(c) Protective inoculation of stock in India, by A. W. Shilston, M.R.C.V.S., Assistant Bacteriologist in charge of the office of the Imperial Bacteriologist. *Agri. Jour., Ind.* Vol. XI, Part II.

41. *General remarks.* Although the issues of anti-rinderpest serum for the year under report did not reach the record established in 1914-15, those of anthrax, hæmorrhagic septicæmia and strangles anti-sera each largely exceeded any previous yearly issue and since the issued dose of these

sera is three times as large as that of anti-rinderpest serum, the total quantity of serum prepared was actually 482,315 cc. more than the total for 1914-15, itself a record year.

In addition, the issue of hæmorrhagic septicæmia and black quarter vaccine showed a large increase over 1914-15; special vaccines and ophthalmic mallein were issued for the first time and the output of ordinary mallein was but little short of that for the preceding year.

On account of the numerous changes in the staff and the difficulties connected with the water and fodder supplies, defective centrifuges, and delays in the delivery of glass-ware, etc., from England, the maintenance of the large output from the Laboratory imposed a considerable strain upon all members of the staff concerned.

During my absence from Muktosar in the winter, the routine serum and vaccine preparation was under the direct charge of Dr. Macalister, and I am greatly indebted to him for his willing co-operation at all times.

The three European Laboratory Assistants have discharged their responsible duties with care and thoroughness and their services are fully appreciated.

Mr. Goffi while acting as Farm Manager has displayed energy and tact in carrying out the duties of the post; as a result a welcome change has been produced in the work of the farm staff and the condition of the estate.

I also wish to record my appreciation of the services of Rai Sahib Pandit Krishna Nand, Office Superintendent, whose long experience and knowledge of the office work and local conditions, have been of the greatest assistance to me in dealing with the many difficulties of administration encountered during the past year.

A. W. SHILSTON,

Assistant Bacteriologist,

In charge of the office of the Imperial Bacteriologist.

Table showing the doses of different products issued from the

Name of Sera	QUANTITY ISSUED							
	Punjab	North-West Frontier Province	South Punjab	United Provinces	Bengal	Assam	Bihar and Orissa	Central Provinces
Rinderpest serum	16,000	29,200	35,000	15,000	70,500	114,000	124,000	95,000
Anthrax serum	...	...	...	...	2,500	19,000	6,000	11,000
Hæmorrhagic Septicæmia serum.	5,000	5,000	18,117	8,800	3,000	6,000	12,500	10,500
Hæmorrhagic Septicæmia vaccine.	50	8,400	33,310	700	...	...	78,800	...
Charbon Symptomatique vaccine.	* 1,010	3,500	4,000	...	...	...	200	...
Mallein	474	...	200	57	200	...	...	20
Ophthalmic Mallein	...	...	...	...	12	...	...	...
Tuberculin	† 45	...	20	12	...	...	...	...
Anti-Streptococcic serum.	...	...	...	...	...	...	...	12
Anti-Streptococcic vaccine.	60	...	...	...	...	...	...	6
Staphylococcic vaccine	...	...	...	...	...	...	...	...
Special vaccine	...	...	...	...	...	...	...	...
Streptococcic and staphylococcic (mixed) vaccine.	...	...	...	...	...	...	...	...
TOTAL	22,639	46,100	90,677	24,569	76,212	139,000	221,500	116,538

* Inclusive of 960 doses issued to Hissar Cattle Farm.

† " " 1 dose " " " "

Imperial Bacteriological Laboratory, Muktesar, during the year 1915-16.

IN DOSES

Bombay	Madras	Sind, Baluchistan and Rajputana	Burma	Coorg	Military Department	Native States	Foreign countries	Imperial Bacteriological Laboratory	TOTAL
152,100†	160,000	3,000	15,000	...	92,422	36,100	5,600	6,538	969,460
...	2,500	489	...	1,300	100	5,415	...	33	48,337
5,500	...	3,633	...	...	766	1,033	...	116	79,965
2,260	...	...	...	...	...	600	...	...	124,150
50	...	650	...	...	60	500	...	10,287	20,257
...	260	210	1,100	...	27,364	439	...	8	30,332
100	...	...	...	...	...	...	...	...	112
...	...	...	250	...	106	...	...	1	434
...	...	...	...	...	7,393	340	...	9,387§	17,132
...	...	...	...	...	590	...	...	...	656
...	...	...	...	...	95	...	...	...	95
...	...	...	...	...	205	...	...	...	205
...	...	...	...	...	1,350	...	...	...	1,350
160,010	162,760	7,982	16,350	1,300	130,451	44,427	5,600	26,370	1,292,485

† Inclusive of 700 doses issued to Bombay Municipality.

§ " 7,950 " discarded.

Table showing main results of the working of the Imperial

QUANTITY IN DOSES OF SERA OR ANTI-TOXIN PREPARED AND ISSUED								INSTRUCTION IMPARTED				
	Names of sera or anti-toxin	Opening balance	Prepared during the year	Returned serum	Total	Issued during the year	Stock in hand	Department or Province	European Officers attending class	Number passed	Indian Veterinary Graduates	Number passed
1	2	3	4	5	6	7	8	9	10	11	12	13
Imperial Laboratory.	Rinderpest serum	Doses 69,760	Doses 1,160,650	Doses 400	Doses 1,250,710	Doses 868,400	Doses 287,250	Deputy Superintendent, C. V. D., United Provinces.				
	Anthrax serum	157	71,870	...	72,027	48,337	23,690		...	...	1	1
	Hæmorrhagic Septicæmia serum	100	127,365	...	127,465	70,005	47,500					
	Hæmorrhagic Septicæmia vaccine	...	124,160	...	124,160	124,160	...					
	Charbon Symptomatique vaccine	18,257	60,000	1,400	69,657	20,257	49,400					
	Mallein	9,415	28,009	500	37,924	30,832	7,592	Military Dairy Farm Manager,				
	Ophthalmic Mallein	...	7,127	...	7,127	112	7,015		1	1	...	...
	Tuberculin	730	...	...	730	431	298					
	Anti-Streptococcic serum	13,690	11,243	...	24,933	17,132	7,800	Veterinary College, Lahore.				
	Anti-Streptococcic vaccine	...	650	...	650	650	...					
	Staphylococcic vaccine	...	65	...	65	65	...					
	Special vaccine	...	205	...	205	205	...		1	1	...	...
	Streptococcic and Staphylococcic (mixed) vaccine	...	1,360	...	1,360	1,350	...					
	TOTAL	112,109	1,603,019	2,800	1,723,028	1,202,485	430,543		2	2	1	1

Bacteriological Laboratory, Muktesar, during the year 1915-16.

FINANCIAL RESULTS

RECEIPTS					EXPENDITURE					
Sale of sera	Sale of animals	Sale of garden products and Reserved Forests	Other miscellaneous receipts	Total	Salaries and allowances of officers and establishments	Feed and keep of animals	Cost of chemicals and apparatus	Other miscellaneous expenditure	Purchase of animals	Total
14	15	16	17	18	19	20	21	22	23	24
Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs.
133,103 13 5	200 0 0	870 5 0	164 1 0	134,347 3 5	68,100 7 2	60,514 8 0	11,083 7 0	32,042 1 0	10,557 2 0	11,263 10 1
133,103 13 5	200 0 0	870 5 0	164 1 0	134,347 3 5	68,100 7 2	60,514 8 0	11,083 7 0	32,042 1 0	10,557 2 0	11,263 10 5